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Association between participation in outdoor play and sport at 10 years old with physical activity in adulthood

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Abstract

Objective

This study aimed to investigate whether active outdoor play and/ or sports at age 10 is associated with sport/ physical activity at 32 year follow-up using a birth cohort study.

Methods

Data were from the 1970 British Cohort Study, a longitudinal observational study. The present paper included data from the age 10 year and age 42 year surveys. At age 10 the participant's mother provided information regarding how often their child played sports, and played outside on streets, parks or playgrounds. At age 42 participants reported frequency of participation in physical activities and sports. Associations between participation in sport/ active outdoor play at aged 10 years and adult sport/ physical activity were investigated using adjusted (gender, fathers socio-occupational class, child's BMI, father's BMI, self-rated health at age 42, assessment of own weight at age 42, participant's education) Cox regression.

Results

Final adjusted Cox regression models showed that participants (n=6,458) who often participated in sports at age 10 were significantly more likely to participate in sport/ physical activity at age 42 (RR 1.10; 95% CI 1.01 to 1.19). Active outdoor play at age 10 was not associated with participation in sport/ physical activity at age 42 (RR 0.99; 95% CI 0.91 to 1.07).

Conclusion

Childhood activity interventions might best achieve lasting change by promoting engagement in sport rather than active outdoor play.

Key words: physical activity/ sport/ correlates/ birth cohort/ childhood

Introduction

Current levels of physical activity in westernised society are low. In a recent study of adults (>15 years) from 122 countries (Hallal et al. 2012), approximately a third (31.1%) were physically inactive (defined as not meeting physical activity recommendations). This is problematic because of the various benefits attributable to physical activity. Throughout the life course physical activity aids in the prevention against non-communicable disease risk factors (eg, hypertension, high cholesterol, obesity; Warburton et al. (2006) and Janssen et al. 2010)). Furthermore, physical activity may benefit psychological health by aiding in the reduction of anxiety and depression and contributing to the improvement of self-esteem (WHO 2010). Physical activity may also yield financial benefits for the individual; compared to their inactive peers, physically active children tend to be significantly healthier and wealthier as adults (Stevenson et al., 2010).

Identifying correlates of physical activity can help intervention efforts to increase population levels of physical activity, by variously suggesting targets for behaviour change intervention, mechanisms through which change might be achieved, or identifying groups at risk of low levels of physical activity. Correlates of physical activity in adults have been well researched. For example, a systematic review (Trost et al., 2002) identified 38 studies investigating correlates of physical activity in adults. Key findings from the review concluded that the most consistent correlates of physical activity are gender, age and socio-economic-status (SES). Interestingly, past exercise behaviour is a consistent predictor of current activity status. However, these studies largely relied on retrospective recall. For example, Brenes et al. (1998) asked 105 older adults if they had participated in regular exercise in each decade of life beginning in childhood. It was found that a history of life time exercise predicted current

exercise behaviour. A recent review identified 28 papers and concluded that physical activity tracks from childhood to adulthood, for example, Kappa statistics were reported for 4 cohorts in two studies (Anderssen et al. 2005 and Boreham et al. 2004). Kappa statistics were significant in all four cohorts of males (ranging from 0.14 to 0.38). In females the relationships were weaker, ranging from 0.02 to 0.18, with only the two stronger associations found to be statistically significant (Craigie et al., 2011). However, previous studies tracking activity over the life course have mostly failed to distinguish between different forms of physical activity. Telama et al. (2005) administered a short questionnaire repeated at five time points between ages 3 years to 39 years and found that physical activity from age nine years to 18 years tracked into adulthood. The level of physical activity in adulthood was not dependent on the type of physical activity performed at a young age (leisure-time physical activity, participation in sport club training, participation in competitive sports events, common activity during leisure time, school physical education grades, and type of school commute). Some research has shown that sport (sport may be defined as an activity involving physical exertion and skill in which an individual or team competes against another) participation tracks from adolescence to adulthood (Kjonniksen et al., 2008 and Tammelin et al., 2003). For example, Kjonniksen et al. found that jogging, hiking, ball games, and skiing showed a high degree of tracking from age 15 years to 23 years. One specific domain of physical activity in childhood that has not been previously considered as a potential predictor of adult physical activity is "active outdoor play." Children have been shown to be inherently more active when outside (Cooper et al., 2010 and Cleland 2008). Outdoor play might track into adulthood, because it promotes motor skills and physical development (Fjortoft et al. 2004) conducive to physical activity participation in adulthood.

It is plausible to assume that two of the most dominant domains of physical activity in children include active outdoor play and participation in sports. The aim of this paper is to

investigate whether active outdoor play and/ or sport at age 10 is associated with participation in sport/ physical activity at 32 year follow-up using a birth cohort study.

Materials and Methods

The 1970 British Cohort Study (BCS70) follows the lives of 17, 284 people born in England, Scotland and Wales in a single week in 1970. The present analysis incorporates data from the age 10 and age 42 year surveys. At the age 10 survey conducted in 1980/ 81, parents provided informed consent and were interviewed about the child's home background, social experience, hospital admissions, accidents, and number of factors concerning the experiences concerning the child and the family. The information was gathered through a structured interview with the mother of the child or if she was not available, with someone who had knowledge of the child's health and development. The age 42 survey was conducted in 2012/ 13 and comprised of a 60 minute face-to-face computer-assisted-personal-interview. The present analysis focused only on the variables described below and tracked the same individuals from childhood to adulthood. Participants provided informed consent and all data collection on BCS70 has received full ethical approval. In accordance with University College London Research Ethics Committee Guidance, ethical approval was not required to perform secondary analyses on anonymous health surveillance survey data.

Variables at age 10

The cohort members' mothers provided information regarding how often their child played sports (categorised as: never/ sometimes; often), and played outside on streets, parks or playgrounds (never/ sometimes; daily). The health visitor objectively recorded height and body mass, from which body mass index (BMI) was calculated in kg/m^2. Parents provided

information on their occupation, which was categorised using the 1970 and 1980 Office of Population Censuses and Surveys Classification of Occupations (managerial/ professional/ intermediate/ routine and manual), and also provided self-reported height and weight, from which BMI was calculated.

Variables at age 42

Respondents reported frequency of participation in 15 types of physical activities and sports (see Table S1) (every day/ 5-6 times a week/ 2-3 times a week/ once a week/ 2-3 times a month/ less often/ not in the last 12 months). In addition they were asked "the number of days in a typical week you undertake 30 minutes or more of exercise". Self-rated health (excellent/ very good/ good/ fair/ poor); assessment of own weight (about right/ underweight/ overweight/ very overweight); and education (None/ GCSE or O-level/ A-level/ University degree) were recorded.

Analysis

The same individuals were tracked from childhood to adulthood. Since an odds ratio can be challenging to interpret when the outcome is common we estimated the relative risk (RR), by applying Cox regression with robust variance using a constant in the time variable (Barros et al. 2003), and 95% confidence intervals (CI) to examine the likelihood of participation in physical activity in adulthood (at least 2-3 times a week) in relation to baseline independent variables at age 10 (outdoor play and sports participation) and covariables (sex, fathers occupation, child BMI [using sex specific z-scores], and father BMI). This outcome was chosen as people participating in activity at least 2-3 times a week are likely to approach the

minimum PA recommendation of 150 mins/wk. We present three different models. Firstly an unadjusted model; secondly a model mutually adjusted for independent variables and covariables at age 10; lastly a model with additional adjustment for covariables at age 42 (self-rated health, assessment of own weight, and participant's education). These covariables are likely to track from childhood to adulthood and are therefore feasibly associated with both the exposure and the outcome. In sensitivity analyses we used "meeting physical activity guidelines" (30 minutes exercise on at least 5 days a week) as the outcome. All analyses were conducted using SPSS version 20.

Results

At the age 10 survey 14,874 cohort members participated and 66.2% of them took part in the age 42 survey. After excluding missing data the final analytical sample comprised 6,458. Compared with the analytic sample, those excluded from the final sample were more likely to be from lower social status families (% with father reporting routine/manual occupation: 14.0 vs. 18.8 %, $p<0.001$), and more likely to report daily active play outdoors at age 10 (41.0 vs. 44.7%, $p<0.001$).

Just under half (~41%) of the sample reported daily active play outdoors and approximately 54% participated in sports regularly at 10 years of age (Table 1). In adulthood 40.4% of the sample reported participating in physical activities at least 2-3 times a week. Regular physical activity in adulthood was associated with better self-rated health at aged 42, higher education, and reporting normal body weight in adulthood (Table 1).

The final adjusted Cox regression model (Table 2) showed that participants who often participated in sports at age 10 were significantly more likely to participate in physical

activity at age 42 (RR 1.10; 95% CI 1.01 to 1.19). Active outdoor play at age 10 was not associated with participation in physical activity at age 42 (RR 0.99; 95% CI 0.91 to 1.07). Females were more likely to participate in physical activity at age 42 (RR 1.10; 95% CI 1.01 to 1.19). Participants with a higher BMI at age 10 were significantly more likely to participate in physical activity at age 42 (RR 1.17; 95% CI 1.08 to 1.27).

Children with fathers in routine/manual occupations were less likely to participate in physical activity in adulthood (RR 0.81; 95% CI 0.68 to 0.97), although this association did not remain after adjusting for the participants own educational attainment.

In sensitivity analyses we used "meeting physical activity guidelines" (30 minutes exercise on at least 5 days a week) as the outcome, and calculated that 23.3% of the sample met the physical activity recommendation. Sports at age 10 remained associated with meeting recommendations although was attenuated to the null in adjusted models (see Supplementary material, table S2).

Insert Table 1 and 2 about here

Discussion

The present analysis found that those who often participated in sports at age 10 were significantly more likely to take part in physical activity at age 42 whereas active outdoor play at age 10 was not associated with participation in physical activity at age 42. The finding that sports participation in childhood predicted physical activity in adulthood supports previous research which has found that past physical activity behaviour is a predictor of physical activity behaviour in later life (Tammelin et al., 2003). It is well documented that early life course experiences shape health outcomes well into adulthood and durable exercise patterns take form during childhood (Umberson et al., 2010). One possible explanation for this is that participating in physical activity at a young age forms a preference for physical activity participation which is maintained throughout life. It has also been suggested that childhood physical activity may aid development of motor skills, increasing the probability of being active in later life (Telama et al., 2005). Yet, we showed that sports in childhood determined adulthood physical activity, but levels of outdoor play did not, suggesting that some types of physical activity may better track into adulthood than others. While childhood physical activity *per se* yields health benefits, long-term maintenance of these benefits may best be aided by childhood interventions that prioritise sports engagement over unstructured outdoor play.

Little evidence is available on active outdoor play as a predictor of physical activity in later life. In the present analysis, participation in sport at age 10 was associated with participation in physical activity at age 42, but active outdoor play was not. One possible explanation for the different effects of outdoor play and sports engagement is that, unlike participation in sport, outdoor play is a childhood behaviour; adults do not 'play' in the outdoor environment

in the same way as do children. Children engage in outdoor play as a form of entertainment, rather than to achieve the health benefits conferred by being physically active (Brockman et al., 2011). Whereas sports enjoyed in childhood may form lasting preferences that persist into adulthood, preferences for active outdoor play formed during childhood may fade as a child ages, as preferred and normative sources of entertainment shift away from "playing outside" to for example, playing video games. One possible explanation for childhood sport engagement predicting adult physical activity is that team sports may confer psychosocial benefits that sustain activity. It has been suggested that intrinsic motivation for physical activity – i.e., wanting to be physically active due to the pleasure or satisfaction derived from the experience of activity itself, rather than from its consequences – may support physical activity across the life course (Telama et al., 2005). While not all children are inherently interested in physical activity, intrinsic motivation can be fostered through experiences that make the child feel competent, autonomous, and part of a valued social unit (Ryan et al., 2000). The achievement of team successes, and the social rewards of team membership, may make participation in structured team sports particularly conducive to intrinsic motivation for both continued engagement in sport and in physical activity more broadly. By contrast, outdoor play is a relatively unstructured form of physical activity, the meaning and constituent activities of which vary from child to child (Brockman et al. 2011), and so outdoor play may have less overall impact, or a less consistent impact, on intrinsic physical activity motivation. An alternative explanation to the lack of association between outdoor play during childhood and sports participation in adulthood may be that of unmeasured confounding variables. For example, the degree of independence the child had at age 10 may have determined the frequency they played outdoors (Wen et al. 2009). If sport participation in childhood is supervised then this may explain its higher frequency. In this case, not accounting for level of independence may dilute the association between outdoor play in

childhood and participation in sport during adulthood, if an association does indeed exist. Our data do not allow us to test these explanations, or indeed probe for any mechanism for the observed effect of engagement in sport during childhood on later physical activity. Further research to confirm our findings, and to compare structured sports performance with unstructured outdoor play, is warranted. Nonetheless, it would seem prudent for interventions seeking to increase population levels of physical activity to target childhood sport participation rather than active outdoor play, as a means of sustaining activity across the life course.

It is, however, important to note the benefits of outdoor play in young people. As well as the health benefits of physical activity, which outdoor play is a form of, outdoor play facilitates social competence, problem solving, creative thinking, and safety skills (Rivkin, 1995; Moore & Wong, 1997), it also allows children to grow emotionally and academically (Kosanke & Warner, 1990; Guddemi & Eriksen, 1992). Therefore, interventions may wish to target both active outdoor play and sports participation to maximise the benefits for children's health and development.

The present analysis also found that a higher BMI at age 10 was associated with participation in physical activity at age 42. It is well documented that BMI is not an accurate measurement of adiposity, particularly among children in the normal weight range (Burkhauser et al., 2008). It is possible that at age 10 those children with greater lean muscle mass and therefore a higher BMI may be more likely to take up sport, as they may have an advantage and excel, particularly in contact sport, and thus form a preference for this behaviour which may then continue into later life.

In a review by Trost et al. (2002) it was concluded that physical activity participation was consistently higher in men than in women. However, the present analyses showed that girls

were significantly more likely to participate in physical activity at age 42. One possible explanation for this inconsistency could be a "cohort effect" meaning that the "norm" for individuals incorporated into the cohort may be different, for example, owing to all the participants being born in a single week in 1970 or residing in England. Further research is warranted to better understand this difference between studies.

There are a number of limitations that should be considered. Inconsistencies between parents (age 10 surveys) and participants (age 42 surveys) may have introduced bias. As one example, parents may have overestimated child participation in sport because they perceive it to be an indicator of good parenting whereas participants (age 42) may have under reported, owing to poor recall ability. Nevertheless, using a birth cohort design is more advantageous than using retrospective recall in adulthood. Another possible limitation arises from the reliance on an imprecise mother-reported measure of child participation in sport and outdoor active play at age 10. This particular measure was not validated in BCS70, although previous work has shown mother-reported questionnaires on physical activity correlates have reasonable validity and internal consistency (McMinn et al., 2009). It is also possible that mothers may be more likely to report sport more accurately due to its structured nature and may be less accurate at reporting active play - which may occur in situations such as before and after school when the mother may have no knowledge. Moreover, only frequency of outdoor play without reference to recall period was reported, this may not be a sensitive marker for play (no intensity or time) to understand its true effects. A clear strength of this study is its prospective design and 32 year follow-up in a population-based sample of English, Scottish and Welsh adults. A further strength is the inclusion of "active outdoor play" as a potential correlate of physical activity in adulthood.

Conclusion

In the present analysis participation in sport, but not active outdoor play, at age 10 was associated with participation in physical activity at age 42. Childhood activity interventions might best achieve lasting change by promoting engagement in sport rather than active outdoor play. More research on active outdoor play, which elaborates on time and intensity, is warranted.

Conflict of Interests Statement

The authors declare that there are no conflicts of interest.

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Table 1. Descriptive characteristics of the sample relative to participation in sports/physical activity at follow up (age 42). Data from the 1970 British Cohort Study

Variables at baseline (age 10)	**Participation in sports/PA age 42**		
	None (n=3848)	At least 2-3/wk (n=2610)	P-value
Gender			
Boys	1894 (49.2)	1221 (46.8)	0.05
Girls	1954 (50.8)	1389 (53.2)	
Active outdoor play†			
Never/ sometimes	2199 (57.1)	1562 (59.8)	0.03
Often (daily)	1649 (42.9)	1048 (40.2)	
Playing sports at age 10			
Never/ sometimes	1805 (46.9)	1147 (43.9)	0.02
Often	2043 (53.1)	1463 (56.1)	
Fathers socio-occupational class			
Managerial	244 (6.3)	203 (7.7)	<0.001
Professional	966 (25.1)	755 (28.9)	
Intermediate (skilled & non-skilled)	2051 (53.3)	1318 (50.4)	
Routine/manual	586 (15.2)	334 (12.8)	
Fathers body mass index	24.5± 3.0	24.3± 2.8	0.02
Child body mass index	16.8± 2.1	16.9± 2.1	0.30
Variables at follow up (age 42)			
Self-rated health			
Excellent	699 (18.2)	765 (29.3)	<0.001
Very good	1379 (35.8)	1013 (38.8)	
Good	1135 (29.5)	582 (22.2)	
Fair – poor	635 (16.5)	250 (9.6)	
Education			
None	1084 (28.2)	598 (22.9)	<0.001
GCSE/O-level	1298 (33.7)	813 (31.1)	
A-level	512 (13.3)	403 (15.4)	
University degree	954 (24.8)	796 (30.5)	
Self-rated body weight			
About right	1191 (31.0)	1129 (43.2)	<0.001
Underweight	126 (3.3)	71 (2.7)	
Overweight	1776 (46.2)	1103 (42.2)	
Very overweight	755 (19.6)	307 (11.8)	

Percentages denoted in brackets.

† Active play on streets, parks or playgrounds

PA: Physical Activity; GCSE: General Certificate of Secondary Education

Table 2. Association between baseline characteristics (age 10) and participation in sport/physical activity at age 42 (n=6,458). Data from the 1970 British Cohort Study

Baseline variables	**RR (95% CI) for PA participation age 42**		
	Univariate model	Multivariate model 1†	Multivariate model 2‡
Gender			
Boys	Ref	Ref	Ref
Girls	1.06 (0.98 – 1.15)	1.08 (0.99 – 1.17)	1.10 (1.01 – 1.19)
Active outdoor play at age 10			
Never/ sometimes	Ref	Ref	Ref
Often (daily)	0.94 (0.87 – 1.01)	0.96 (0.88 – 1.04)	0.99 (0.91 – 1.07)
Playing sports at age 10			
Never/ sometimes	Ref	Ref	Ref
Often	1.07 (0.99 – 1.16)	1.11 (1.02 – 1.20)	1.10 (1.01 – 1.19)
Fathers socio-occupational class			
Managerial	Ref	Ref	Ref
Professional	0.97 (0.83 – 1.13)	0.97 (0.83 – 1.14)	1.01 (0.86 – 1.18)
Intermediate (skilled & non-skilled)	0.86 (0.75 – 1.00)	0.88 (0.76 – 1.02)	0.96 (0.82 – 1.11)
Routine/manual	0.80 (0.67 – 0.95)	0.81 (0.68 – 0.97)	0.92 (0.77 – 1.10)
Child BMI age 10 (per sex specific SD increase)	1.06 (0.99 – 1.14)	1.08 (1.01 – 1.17)	1.17 (1.08 – 1.27)
Father BMI (per unit increase)	0.99 (0.98 – 1.00)	0.99 (0.97 – 1.00)	1.00 (0.98 – 1.01)

†multivariate model 1 mutually adjusted for all baseline independent variables.

‡multivariate model 2 additionally adjusted for: self-rated health age 42 (excellent; very good; good; fair; poor); assessment of own weight at age 42 (about right; underweight; overweight; very overweight), participant's education (higher education; A-levels; GCSEs/O-levels; no education).

PA: Physical Activity; GCSE: General Certificate of Secondary Education